Order Code RL34666

CRS Report for Congress

The Department of Defense, Science and Technology Program: An Analysis, FY1998-FY2007

September 12, 2008

John D. Moteff
Specialist, Science and Technology Policy
Resources, Science, and Industry Division

Prepared for Members and Committees of Congress

Report Documentation Page

Form Approved
OMB No. 0704-0188

Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
12 SEP 2008		**00-00-2008 to 00-00-2008**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
The Department of Defense, Science and Technology Program: An Analysis, FY1998-FY2007	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Congressional Research Service,The Library of Congress ,101 Independence Ave, SE,Washington,DC,20540-7500**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT **unclassified**	b. ABSTRACT **unclassified**	c. THIS PAGE **unclassified**	**Same as Report (SAR)**	**18**	

Department of Defense, Science and Technology Program: An Analysis, FY1998-FY2007

Summary

Every year Congress appropriates billions of dollars for the Science and Technology Program of the Department of Defense. Besides deciding on how much money to appropriate, Congress must also decide on how best to allocate those resources. Over the last ten years, the Science and Technology program has grown to historic levels in inflation-adjusted dollars. However, the funding increases appear to have peaked. In light of growing federal budget deficits, Congress may re-examine its investments in DOD's S&T program. Before doing that, it might be helpful to understand how the budget increases of the last ten years have been allocated. That is the purpose of this report.

Between FY1998 and FY2007, the annual budget of the Department of Defense (DOD) Science and Technology (S&T) program grew from $7.7 billion to $12.8 billion. The cumulative increase, in constant FY2009 dollars, was $22.5 billion.

The increase was distributed broadly across the S&T program. In constant dollars, the S&T budget of all departments (Army, Navy, and Air Force) and all defense agencies increased (except that of the Missile Defense Agency). While there was some variation in the distribution, no single department, agency, budget activity or program predominated.

Of the three budget activities that make up the S&T program — basic research, applied research, and advanced technology development — basic research increased the least. The increase in basic research varied widely between departments and agencies. Army, Navy, and Air Force advanced technology development, and Defense Advanced Research Project Agency (DARPA) applied research received the highest increases.

Considering individual program elements, the Army's Combat Vehicle and Advanced Automotive Technology advanced technology development program received the single largest increase in constant dollars ($1.7 billion FY2009 dollars). The mission area that attracted the greatest increases was countering weapons of mass destruction. Four of the eleven S&T program elements that received the highest increases were related to this mission.

This report will not be updated.

Contents

List of Figures

List of Tables

Department of Defense, Science and Technology Program: An Analysis, FY1998-FY2007

Introduction

Between FY1998 and FY2007, the annual budget of the Department of Defense (DOD) Science and Technology (S&T) Program grew from $7.7 billion to $12.8 billion. In constant FY2009 dollars, the cumulative increase was $22.5 billion. The purpose of this report is to aid Congressional oversight of DOD's S&T program by analyzing this budget increase by department and agency, by budget activity, and by program element. Specifically, the report examines whether the budget increase benefitted all programs or focused on certain priority areas. In a period of higher budget deficits, as sustaining current levels of military spending becomes more of a fiscal challenge, and as the nation continues to position itself to engage effectively in a changing strategic environment, policymakers may scrutinize the allocation of S&T resources more closely.

What Constitutes Defense Science and Technology

This report focuses on DOD's base Research, Development, Test, and Evaluation Program (RDT&E).[1] As indicated by its name, this program funds activities that range from fundamental research in the basic sciences to the design, development, and testing of complex weapon systems ready for the field. The DOD divides this range of effort into seven budget activities, designated 6.1 through 6.7 (see Appendix). Activities 6.1 through 6.3 (basic research, applied research, and advanced technology development) constitute what is called the Science and Technology (S&T) program. Budget activities 6.4 and 6.5 focus on the development of specific new weapon systems or components (e.g., the Joint Strike Fighter or missile defense systems).[2] Budget activity 6.6 provides management support, including support for test and evaluation facilities. Budget activity 6.7 supports system improvements in existing operational systems.

---

[1] The base RDT&E program is funded by Title IV of the annual defense appropriations legislation. Additional RDT&E funds are also found in other parts of the DOD's appropriation, including some RDT&E funding specifically in support of the Global War on Terror (GWOT). GWOT funds are requested and appropriated separately from the base program. This report only considers the Title IV base funding.

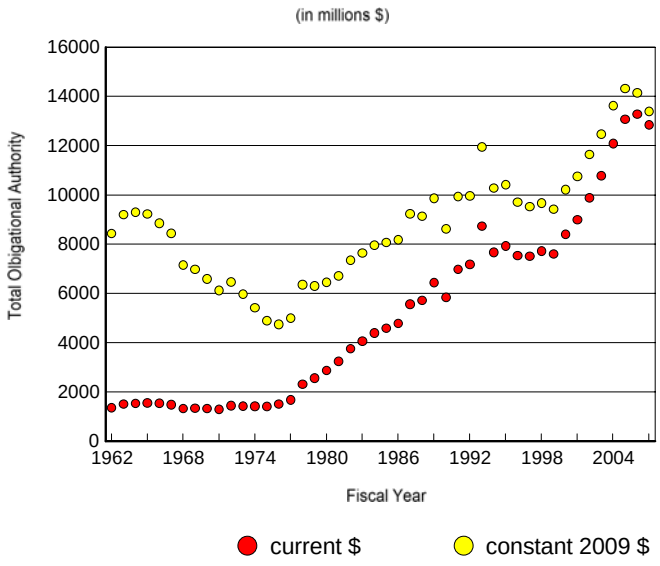
[2] Some analysts include select activities within budget activity 6.4 as part of the S&T program. This report considered only programs in the 6.1 through 6.3 budget activities.

The S&T program is often referred to as DOD's "seed corn" because it supports the development of a science and technology base upon which tomorrow's high performance military systems will be built. The payoff from S&T investments is rarely immediate. The value of the knowledge tends to be unpredictable and hard to measure. The operational capabilities that are developed take time to be incorporated into fielded systems. Nevertheless, adequate support for S&T activities is seen by many in Congress and the defense community as imperative to maintaining U.S. military capabilities and superiority.

Funding Trends in DOD S&T

Figure 1 shows the DOD S&T budget from FY1962 (when the budget activity designations 6.1-6.7 were first being adopted) through FY2007. During the 1960s and early 1970s, budgets for S&T remained relatively flat in current dollars, with inflation eroding their real values in constant dollars. Beginning in the late 1970s and continuing through much of the 1980s, S&T budgets increased in both current and constant dollars.

Figure 1. S&T Budget Profile, FY1962-FY2007



Source: CRS analysis of DOD data provided by Director of Defense Research and Engineering, Plans and Programs and R-1 documents, FY2000-FY2009.

At the end of the 1980s and into the 1990s, the Cold War began to wind down, but budget deficits of the federal government continued to grow. Funding for S&T became more erratic before essentially leveling off in constant dollars.

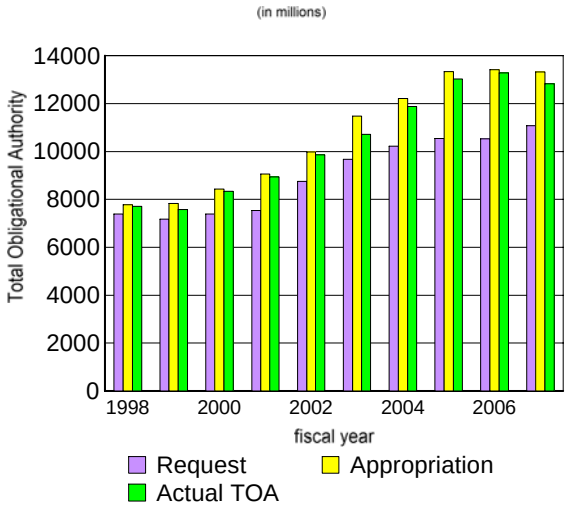
By the end of the 1990s, sustaining adequate support for S&T in a time of declining military spending became a particular concern. Congress initially sought

to increase S&T funding by 2% per year after inflation,[3] but achieved limited success toward this goal. During the 2000 election, the Bush presidential campaign advocated a general increase in military research and development as part of its proposal to increase military spending. As part of the 2001 Quadrennial Review, the DOD established a goal of stabilizing its base S&T funding at 3% of DOD's overall funding.[4] Congress embraced this goal.[5] Following the terrorist attacks of September 11, 2001, overall defense budgets began to rise quickly. Although not always achieving the 3% goal, S&T funding rose to historic levels, in both current and constant dollars.

Congressional Support for Increased S&T Funding

Figure 2 shows the role Congressional appropriations played in the general increase in S&T funding from FY1998 to FY2007. DOD began seeking increases to the S&T budget beginning in FY2002. However, Congress appropriated more than DOD requested throughout this time period.

Figure 2. S&T Funding Requests vs. Appropriations vs. Actual Total Obligational Authority



Source: CRS analysis of DOD R-1 data and conference reports accompanying appropriations bills.

Note: The appropriations data used in this graph are those identified in Title IV of DOD's appropriation bills. It does not include general reductions that are often called for in the General Provisions title of those bills. The "actual TOA" data recorded take these general reductions, and other modifications to the original appropriations, into account, as explained further below.

---

[3] §214, Strom Thurmond National Defense Authorization Act for FY1999, P.L. 105-261.

[4] Department of Defense. Quadrennial Defense Review Report. September 30, 2001. p. 41.

[5] Conference report accompanying H.R. 4546, National Defense Authorization Act for Fiscal Year 2003. H.Rept. 107-772. p. 460.

Analysis

This report focuses on the growth in the base S&T budgets between FY1998 and FY2007. This period of time is interesting to policymakers for several reasons. It includes the transition in FY2000 to a period of significant and historic growth in the S&T budget. It includes a change in Administration, as well as the historic strategic transition from the post-Cold War era to the War-on-Terror era. Picking FY1998 as the baseline year is somewhat arbitrary, but because S&T funding for the three years prior to FY1998 was relatively stable, it would appear to represent a valid starting point. Also, declines in overall defense spending, beginning in FY1986, bottomed out in FY1998, representing the end of the post-Cold War draw-down. The period of analysis ends in FY2007, the latest budget year for which "actual" S&T funding data exist (see below).

Methodology

The analysis in this report is based on data from two primary DOD sources: the DOD R-1 document, and the RDT&E descriptive summaries of the departments and agencies.

The R-1 is an annual budget document released by the DOD Comptroller that summarizes all the Program Elements (PEs) that make up the base Research, Development, Test, and Evaluation (RDT&E) program. Program Elements are the building blocks of DOD's budget. In the case of the base RDT&E program, each PE represents an aggregation of research activities in a particular area. These areas could be related to a discipline (e.g. materials science), or mission (e.g. electronic warfare), or subsystem (e.g. propulsion technologies). Every RDT&E dollar is associated with one, and only one, PE. The R-1 document lists all of these PEs, broken out by department and agency and by budget activity (6.1-6.7). In the FY2009 RDT&E budget request, there were 712 PEs, of which 157 were considered to be in the S&T program.

The RDT&E descriptive summaries are released each year by the departments or agencies, usually a few days after the official release of the DOD budget. They provide a written description of each PE and include, among other information, goals and objectives and past and anticipated accomplishments. In many cases, a PE may be divided into one or more projects. This report does not examine projects below the PE level.

The funding amounts identified in these documents are total obligational authority (TOA). TOA is a DOD financial measure. In any given budget request, TOA equals budget authority (BA), which is what Congress grants in its appropriations bills (i.e. the authority to incur legally binding obligations). It expresses the value of the direct program. If changes are made to appropriations granted by Congress, because of general reductions, rescissions, lapsing unobligated funds, transfers of unobligated funds, re-appropriations, etc., these changes are accounted for differently when modifying the TOA and budget authority figures for

prior years.[6] The R-1 and the RDT&E descriptive summaries list the current year's budget request, an *estimated* TOA for the immediate prior year (which may include rescissions proposed in the current year's budget), and the *actual* TOA for two years prior (by which time most modifications to the initial appropriation's Budget Authority will have been made). The analysis in this report used actual TOA for FY1998 through FY2007, as shown in the R-1 documents for FY2000 through FY2009. It includes all S&T PEs listed in the R-1 documents for those years.

The TOA data were recorded in current dollars. These data were converted to constant FY2009 dollars using TOA deflators for RDT&E taken from the DOD's National Defense Budget Estimates for FY2009. Unless stated otherwise, from here on in this report, all data is given in FY2009 dollars.

The basic analysis compared the cumulative actual funding, from FY1998 through FY2007, in constant FY2009 dollars with what the cumulative funding would have been if the FY1998 amount had risen only with inflation. This comparison was done by department and agency, by budget activity, and by individual PE. The comparisons were calculated both in dollars and as percentages. Percentage changes take into account the size of the program. Changes in low cost programs, when measured in absolute dollars, may conceal the relative importance of the change as might be revealed when looking at the change in terms of percentages. On the other hand, initial changes in low cost programs could lead to relatively large percentage changes at first, and perhaps overstate the importance of those changes. The analysis takes this issue into consideration.

The methodology used in this analysis has a couple limitations. One problem is how to account for PEs that were initiated after FY1998. In these cases, the FY1998 baseline funding is zero. That does not present a problem when analyzing in terms of dollars, but it makes the percentage comparison meaningless. One could use the first year the PE was established to determine a truncated baseline for calculating the percentage increase or decrease. This, however, would not allow for a direct comparison with PEs that were in existence in FY1998. Therefore, the analysis of percentage changes in individual PEs is restricted to PEs that were in existence in FY1998 and does not include PEs established after that time.

Another limitation is that some PEs were reorganized during the course of the 10 year period. In some cases, PEs were terminated and their projects distributed to new or existing PEs. While it is possible in some of these cases to analyze the data for these PEs in the aggregate, in other cases it is difficult to compare the new PEs

---

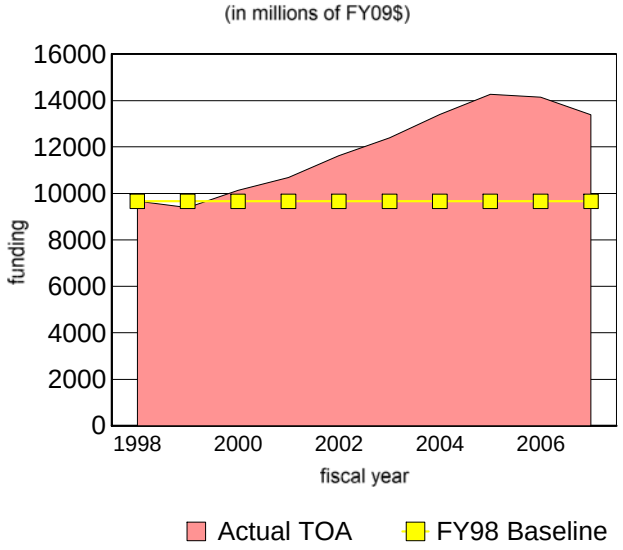
[6] For more discussion of how TOA and BA differ, refer to the National Defense Budget Estimates, FY2009, Office of the Undersecretary (Comptroller), March 2008, p. 1. Known as the Green Book, see [http://www.defenselink.mil/comptroller/defbudget/fy2009/fy2009_greenbook.pdf].

to the old PEs.[7] These situations were handled on a case by case basis, based on the judgement of the author.[8]

Results

For DOD S&T as a Whole. Figure 3 compares actual funding (in FY2009 dollars) with the FY1998 baseline. Baseline funding, in constant FY2009 dollars, was $9.6 billion dollars per year. Actual funding rose to $14.3 billion in FY2005 (in FY2009 dollars), before declining to $13.4 billion in FY2007 (in FY2009 dollars).[9] In total, actual funding exceeded baseline funding by $22.5 billion (in FY2009 dollars), as represented by the area above the baseline line in **Figure 3.**

Figure 3. S&T Funding Above FY1998 Baseline



Source: CRS analysis of DOD R-1 data, FY2000-FY2009.

---

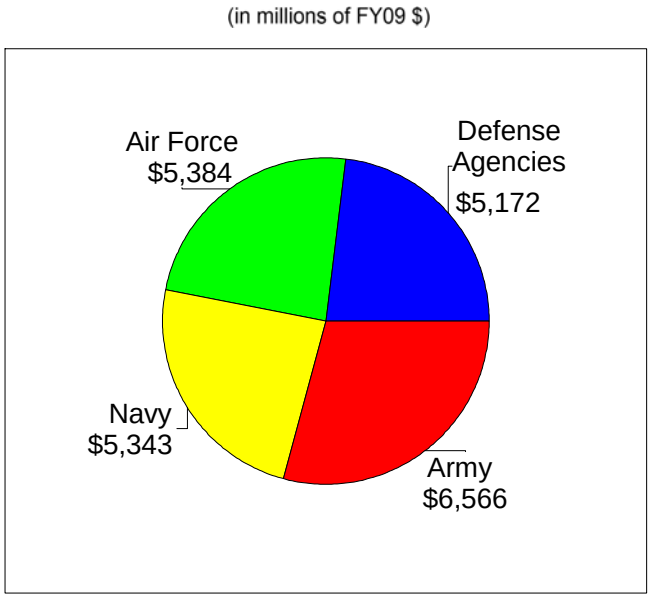
[7] For example, in its FY2002 budget request, the Navy reorganized nearly half its PEs. Projects from old PEs were distributed among a number of new PEs, making tracking those activities difficult across the analysis's time span. As a result, a number of Navy PEs do not lend themselves to this analysis. To a lesser extent, in FY2002, some Air Force PEs were reorganized to align with the newly restructured Air Force Research Laboratory organization, and again in FY2003 to reflect recommendations from the Space Commission to segregate space-related research from the more generic aerospace activities. Some of these changes were later reversed.

[8] For example, in FY2005, in response to Congressional direction, the Defense Advanced Research Projects Agency split a number of PEs in two. In this case, where the integrity of the original PE was more or less preserved in the two new PEs, the analysis treated the three (i.e the old baseline PE and the two new ones) as a single PE.

[9] Note, in current dollars S&T funding peaked in FY2006. In constant FY2009 dollars, it peaked in FY2005.

By Department/Agency. **Figure 4** shows how this extra $22.5 billion was distributed among the DOD departments and defense agencies.[10] The Army received the largest dollar increase — $6.6 billion. Defense agencies, as a whole, increased the least — $5.2 billion.[11] In percentage terms, the three departments fared about equally. The Army's S&T funding increased 34% above its baseline, the Navy's 32%, and the Air Force's 36%. However, the defense agencies, as a whole, increased only 11%.

Figure 4. S&T Funding Above FY1998 Baseline by Department/Agencies, Cumulative FY1998-FY2007



Source: CRS analysis of DOD R-1 documents, FY2000-FY2009.

By Budget Activity. When characterizing the additional $22.5 billion in terms of budget activity (**Figure 5**), $2.3 billion went to basic research (budget activity 6.1), $10.0 billion went to applied research (budget activity 6.2), and $10.1 billion went to advanced technology development (budget activity 6.3). There has been much concern among some analysts and policymakers about maintaining adequate basic research (6.1). In absolute dollars, basic research increased noticeably

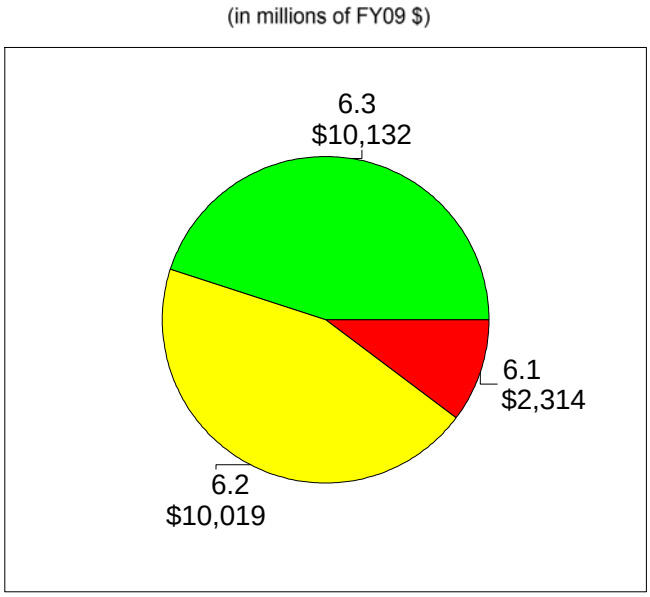
---

[10] Defense agencies that support S&T include the Office of the Secretary of Defense (OSD), the Defense Advanced Research Projects Agency (DARPA), the Missile Defense Agency (MDA), the Defense Threat Reduction Agency (DTRA), the Chemical and Biological Defense Program, the Special Operations Command (SOC), the Defense Logistics Agency, and the DOD Human Resources Activity.

[11] Of the individual defense agencies, DARPA's actual S&T budget exceeded its baseline by the highest amount ($2.5 billion). The MDA's actual S&T budget fell short of its baseline by $2.3 billion. S&T accounts for a very small share of MDA's RDT&E program.

less than 6.2 or 6.3 funding. However, basic research activity tends to be less costly.[12] In percentage terms, the additional 6.1 funds were about an 18% increase above the baseline, while the additional 6.2 and 6.3 funds were respectively 27% and 21% above the baseline.

Figure 5. S&T Funding Above FY1998 Baseline by Budget Activity, Cumulative FY1998-FY2007



Source: CRS analysis of DOD R-1 documents, FY2000-FY2009.

By Department/Agency and Budget Activity. **Table 1** provides a breakdown of the $22.5 billion by both department/agencies and budget activity. **Table 2** gives the same breakdown in percentage terms. While the defense agencies' 6.2 funding accounted for the single largest increase in funding in absolute dollars, the percentage increase was not as large as those of the departments. The largest increases, on a percentage basis, were in the departments' 6.3 funding. The 6.3 programs of the defense agencies, as a whole, received a noticeably lower percentage increase in funding.[13]

---

[12] It is not unusual in DOD, other agencies, or the private sector, for basic research budgets to be lower in absolute dollars than applied research or advanced technology development budgets. One reason for these differences is the cost of performing each type of activity. Basic research may involve theoretical work or laboratory experiments involving small volumes of materials. Advanced development may involve the construction and integration of large hardware and software, tested in specialized test beds.

[13] This is due in a large part to net declines in MDA's and DARPA's 6.3 activities.

There were some significant differences in the funding gains in basic research among the department and agencies. The Army and the Air Force basic research increased 39% and 31%, while the Navy's increased 14% and the basic research across all defense agencies increased only 3%.[14]

Table 1. S&T Funding Above FY1998 Baseline, by Department/Agencies and Budget Activity, Cumulative FY1998-FY2007

(in millions of FY2009 dollars)

Budget Activity	Army	Navy	Air Force	Defense Agencies	Total DOD
6.1	$857	$600	$721	$137	$2,315
6.2	$2,152	$1,970	$2,178	$3,719	$10,019
6.3	$3,557	$2,772	$2,486	$1,317	$10,132
Total S&T	$6,566	$5,342	$5,385	$5,173	$22,466

Source: CRS analysis of DOD R-1 documents, FY2000-FY2009.
Note: Numbers in Table may not agree with Figures above, due to rounding.

Table 2. S&T Funding Above FY1998 Baseline, by Department/Agencies and Budget Activity, Cumulative FY1998-FY2007

(as a percentage of FY1998 baseline funding)

Budget Activity	Army	Navy	Air Force	Defense Agencies	DOD Total
6.1	39%	14%	31%	3%	18%
6.2	26%	34%	32%	24%	27%
6.3	42%	43%	43%	5%	21%
S&T Total	34%	32%	36%	11%	23%

Source: CRS analysis of DOD R-1 documents, FY2000-FY2009.

[14] While the percentage increase in Navy 6.1 funding is lower than the other departments, it maintains the highest 6.1 budget of the three department. The relatively small increase in the Defense Agencies' 6.1 funding is due in a large part to the transfer of the University Research Initiative from OSD to the departments.

By Individual PE. Of the 101 PEs, from all departments and agencies, that were in existence in FY1998 and were continuously funded throughout the 10-year period of the analysis, 74 exceeded their baseline. As noted above, all PEs that were established after FY1998 show an increase above their baseline, even if funding did not keep up with inflation after their initial establishment. Also as noted above, some PEs were eliminated during the 10 year period. The 101 PEs referred to above do not include either the newly created PEs or the baseline programs that were eliminated. The size and distribution of the increases and decreases above and below baseline funding for individual PEs appear to be distributed more or less evenly throughout the range. A complete breakdown by PE is beyond the scope of this report.

Table 3 shows the five PEs whose actual funding exceeded their baseline funding by the greatest amount, as measured in absolute constant FY2009 dollars.[15] **Table 4** below shows the five PEs whose actual funding exceeded their baseline by the greatest percentages. **Table 3** considers and includes PEs that were established after FY1998. **Table 4** does not.

Table 3. Five Individual Program Elements Which Exceeded Their Baseline Funding the Most

(in millions FY2009 dollars)

Budget Activity, Dept./Agency	PE Number	PE Name	Exceeded Baseline by
6.3, Army	0603005A	Combat Vehicle and Automotive Advanced Technology	$1,736
6.3, DARPA	0603285E 0603286E 0603287E	Advanced Aerospace Systems Advanced Aerospace Systems Space Programs and Technology	$1,730
6.2, DARPA	0602712E 0602715E 0602716E	Materials and Electronics Materials and Biological Electronics	$1,514
6.3, Air Force	0603801F	Special Programs	$1,445
6.2, DTRA	0602715BR 0602716BR 0602717BR	WMD Related Technologies WMD Defeat Technology Strategic Defense Technologies	$913

Source: CRS analysis of DOD R-1 documents, and department/agency descriptive summaries, FY2000-FY2009.

[15] For those interested, the five PEs which experienced the greatest decline in actual funding when compared to their baselines were: Missile Defense Agency 6.3 Support Technology (PE0603173C, -$1,330 million); DARPA 6.2 Advanced Electronics (PE0603739E, -$900,589 million); Army 6.3 Aviation (PE0603003A, -$350,349); Army 6.2 Environmental Quality (PE0602720A, -$272,971); and, Air Force 6.3 Spacecraft (PE0603401F, -$227,426). All of these figures are in FY2009 dollars. All of these were in existence throughout the 10 year period, although the Missile Defense Agency PE changed PE number in FY2002. A more detailed discussion of these PEs is beyond the scope of this report.

The Combat Vehicle and Automotive Advanced Technology PE is one of a number of PEs that support the Army's Future Combat System (FCS). The Army has described the FCS as its top priority S&T effort. Funding for this PE rose from $48 million in FY1998 (in FY2009 dollars), prior to the beginning of the FCS effort, to $353 million in FY2003 (in FY2009 dollars), when funding peaked. Funding in FY2007 was $210 million (in FY2009 dollars). As noted below, this PE also experienced one of the larger percentage increases.

The Advanced Aerospace Systems PE was established FY2000. Funding increased substantially in FY2002 and again in FY2003 as DARPA expanded work on unmanned combat air vehicles (UCAVs) and the Orbital Express Space Operations Architecture, a program to develop and demonstrate the ability to perform autonomous on-orbit refueling and reconfiguration of satellites. Congress directed DARPA to split the PE into two separate PEs, Advanced Aerospace Systems and Space Programs and Technology, beginning in FY2005. For this analysis, the three PEs were considered as one. Funding for these activities began at $23 million in FY2000 (in FY2009 dollars) and peaked in FY2004 at $343 million (in FY2009 dollars). Funding for the two new PEs totaled $292 million in FY2007 (in FY2009 dollars).

The Materials and Electronics PE represented a core DARPA program for many years. In FY1998, funding for the PE was $267 million (in FY2009 dollars). In FY2005, Congress split this PE into two. The Materials and Biological Technology PE and the Electronics PE, together, received $554 million in FY2005 (in FY2009 dollars). In FY2007, the two PE received $507 million (in FY2009 dollars). The PE experienced its largest single-year increase in FY2002, due to increased funding for the materials processing project and the establishment of the Beyond Silicon project.

The Air Force's Special Programs PE was established in FY2003. While funding for the PE appears in the R-1 document, the activities it supports are classified and are not included in the descriptive summaries. Initially funded at $105 million in FY2003, it jumped to $408 million in FY2004 (both in FY2009 dollars). Funding in FY2007 was $312 million (in FY2009 dollars).

DTRA's 6.2 Weapons of Mass Destruction (WMD) Related Technologies PE has undergone a couple of name changes, but has continued to focus on two primary topics: counter-proliferation and sustainment. The former deals with preparing for and supporting the military and civil response to WMD events. The latter includes maintaining the viability and credibility of U.S. deterrent forces. Projects within these two areas include modeling, simulation, and testing of WMD effects and environments and the subsequent impact on the ability of U.S. forces to respond under such conditions. The PE also includes the development of vulnerability assessment tools and technologies to improve survivability of U.S. weapon systems and capabilities and those of our allies. It also supports targeting operations of U.S. deterrent forces. In FY2003, Congress directed that the PE be split into two new PEs: WMD Defeat Technology and Strategic Defense Technologies. The original PE received $255 million in FY1998 (in FY2009 dollars) and peaked in FY2002 at $458 million (in FY2009 dollars). The two new PEs received $338 million in FY2007 (in FY2009 dollars).

It is interesting to note that the Chemical and Biological Defense Program (both its 6.2 and 6.3 activities) and DARPA's 6.2 Biological Warfare Defense program were three of the next 6 PEs that received high increases. This, along with the increases allocated to DTRA's WMD Related Technologies PE, may reveal a slight emphasis on efforts to counter weapons of mass destruction.

Table 4. Five Individual Program Elements Which Exceeded Their Baseline by the Greatest Percentage

Budget Activity, Dept./Agency	PE Number	PE Name	Exceeded Baseline by
6.2, Army	0602783A	Computer and Software Technology	484%
6.3, Army	0603005A	Combat Vehicle and Advanced Automotive Technology	358%
6.3, Army	0603654A	Line of Sight (LOS)	343%
6.3, Army	0603710A	Night Vision	209%
6.3, Air Force	0603211F	Aerospace Technologies	152%

Source: CRS analysis of DOD R-1 documents and department/agencies descriptive summaries, FY2000-FY2009.

The Army's 6.2 Computer and Software Technology PE exceeded its baseline funding by nearly five times. However, this is largely because its FY1998 funding was reduced to $824 thousand (in FY2009 dollars) from approximately $2.8 million (in FY2009 dollars) the previous year. The descriptive summary for that year indicated a change in the PE's priorities. Funding jumped back up to $4.7 million in FY1999 (in FY2009 dollars). In FY2007 the PE received $6.9 million (in FY2009 dollars). FY1998 appears to have been a transitional year for the PE.

The Army's 6.3 Combat Vehicle and Advanced Automotive Technology PE is discussed above.

In FY1998, the Army's 6.3 PE Line of Sight (Anti-tank) PE became an Advanced Concept Technology Demonstration program. The PE focused on adapting previously developed technology into an air-mobile configuration to support early entry of U.S. forces into a theater of action. Funding increased from $5.9 million in FY1998 to $85 million in FY2002, then declined to $9.7 million (all in FY2009 dollars) in FY2004. The PE was not funded after FY2004.

Funding for the Army's 6.3 Night Vision PE grew steadily from $22.1 million in FY1998 to $111.7 million in FY2005 before dropping to $77.0 million in FY2007 (all in FY2009 dollars).

Called Aerospace Structures until FY2002, the Air Force's Aerospace Technologies Development/Demonstration PE develops and integrates a wide range of technologies to enhance the performance, cost of operations, and life of current and future aerospace vehicles. The PE was funded at $12.0 million in FY1998 and grew steadily until it peaked at $50.5 million in FY2004. It received $47.4 million in FY2007 (all in FY2009 dollars).

Except for the Army's Combat Vehicle and Advanced Automotive Technology program, these PEs contributed little to the overall increase in S&T funding and their relatively high increases in percentage terms are mainly due to their relatively low funding levels. However, the Army's Night Vision program and the Air Force's Aerospace Technologies Development/Demonstration program did experience steady increases that indicate they were areas of sustained interest during this time period.

Review of Major Findings

- The increase in S&T funding over the 10 years from FY1998 to FY2007 was distributed broadly across the S&T program.

- Each department (Army, Navy, and Air Force) and the defense agencies as a whole shared roughly equally in dollar terms. In percentage terms, the defense agencies' increase, taken as a whole, was noticeably less.

- Although the total increase in S&T funding, in dollar terms, was distributed between departments in roughly equal shares, the increases were distributed variably across their budget activities. Applied research (budget activity 6.3) of each of the departments increased the most and by roughly the same amount when taken as a percentage. Across all of DOD, basic research increased the least in dollar terms, although in percentage terms this varied considerably between departments and agencies.

- Of the PEs that were in existence throughout the 10-year period, 73% exceeded their baseline funding. The increases varied from PE to PE, but the PEs that increased the most represented a relatively small share of the total increase.

- It is difficult to discern any clear "winners" over these 10 years in terms of particular mission, disciplines, or sub-systems. A possible exception may be a growing emphasis on countering weapons of mass destruction. This could reflect a shift away from traditional force-on-force conflict toward a more unconventional post-Cold War threat.

Issues for Congress

Congress has three basic approaches to consider when funding S&T going forward — continue increasing S&T funding, reduce S&T funding, or keep S&T funding flat in inflation-adjusted dollars. Within each option, Congress may also decide to adjust the allocation of resources or keep it more or less the same. For example, the Director of Defense Engineering and Research has advocated more basic research. In an expanding program, Congress may be able to accommodate an increase in basic research (or elsewhere within the S&T program) without having to make other major allocation adjustments. However, in a flat or declining budget, growth in a particular department, agency, program, or budget activity would have to be accompanied by decreases somewhere else. Any such decrease could come from those programs that experienced the greatest increases over the last ten years, arguing that the past growth has been sufficient to meet perceived needs. If, however, these areas of past growth are deemed to require yet more growth, decreases would have to come from elsewhere within the program. In this situation, the relatively few programs that have already experienced decreases could be further reduced, indicating their lower priority. However, any such further reductions could render the program inefficient in trying to meet its goals. Alternatively, decreases could be spread evenly over all other programs, reducing the impact on any particular program areas.

Appendix

Budget Activity/Name	Definitions
6.1 Basic Research	Systematic study directed toward greater knowledge or understanding of fundamental aspects of phenomena and of observable facts without specific applications towards processes or products in mind.
6.2 Applied Research	Systematic expansion and application of knowledge to develop useful materials, devices, and systems or methods...directed toward general non-system specific military needs.
6.3 Advanced Technology Development	Development of subsystems and components and efforts to integrate subsystems and components into system prototypes for field experiments and/or tests in simulated environments.
6.4 Advanced Component Development and Prototypes	[Evaluation of] integrated technologies...or prototype systems in a high fidelity and realistic operating environment....Emphasis is on proving component and subsystem maturity prior to integration in major and complex systems. [These activities are taken in the initial phases of an decision to acquire a specific system to meet a certified military need.]
6.5 System Development and Demonstration	Mature system development, integration, and demonstration, including engineering and manufacturing development. Prototype performance is near or at operational levels. These activities must be successfully completed before the acquisition program can progress to live fire testing and initial operational testing and evaluation of production representative articles.
6.6 RDT&E Management Support	Efforts to sustain and/or modernize the installations or operations of general research, development, test, and evaluation. Includes test ranges, maintenance and support of laboratories, maintenance and operation of test aircraft and ships, and studies and analysis of the research, development, test, and evaluation program.
6.7 Operational System Development	Efforts to upgrade systems that have been fielded or anticipate production funding in the current or subsequent fiscal year.

Source: Excerpted from DOD Financial Management Regulation. 7000.14-R. Volume 2B, Chapter 5. For a full explanation of these activities, see [http://www.defenselink.mil/comptroller/fmr/02b/02b_05.pdf].